

Birds recorded from the Aroa Islands, Malacca Strait

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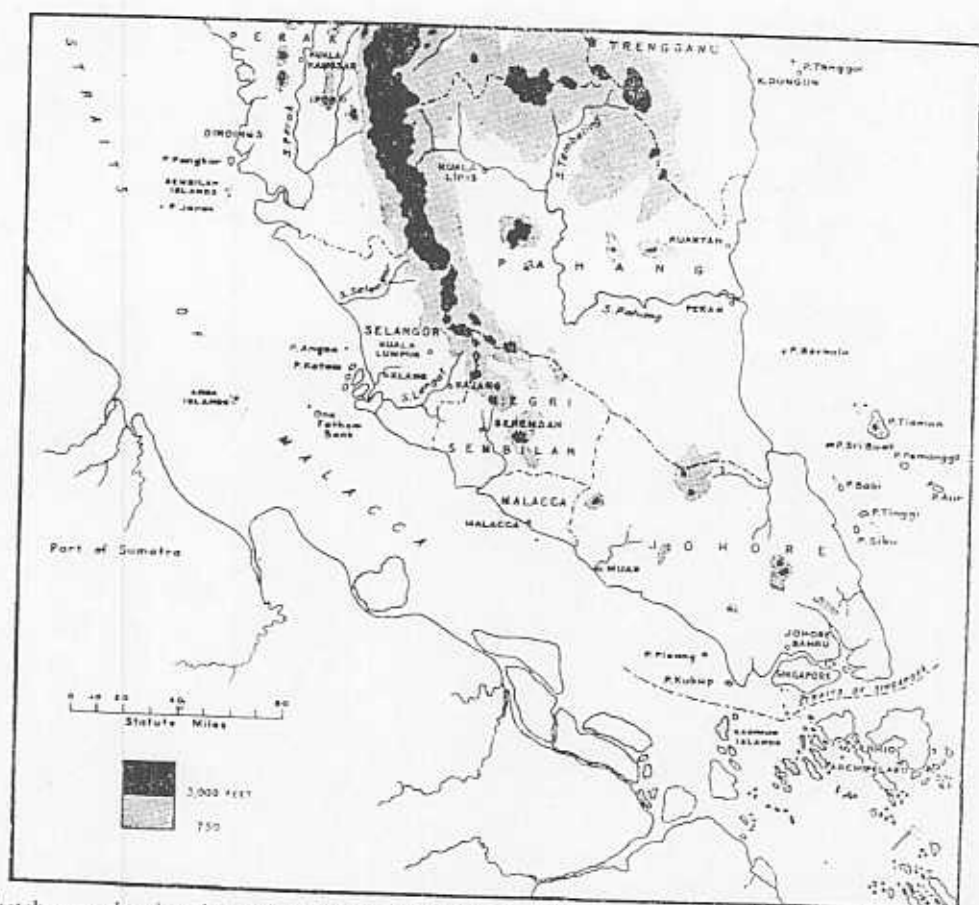
THE AROA ISLANDS lie near the middle of the Malacca Strait, and almost due west from Pulau Lumut, off the mouth of the Klang River. They are rather nearer to the Sumatran side of the strait, but as the North Sands begin about this point on the east side, they are very nearly in mid-channel. They are situated on a bank, with depths of from five to ten fathoms, the northern end of which extends some seven miles north-westward from the main island, while the southern end joins an extensive mud-bank which spreads out from the Sumatran coast opposite the North Sands.

The Aroas consist of two distinct groups of islands. One comprises the main island (Pulau Jemor),¹ with its two adjacent islets, and the line of five small islands known as the Western Aroas. These are of metamorphic formation, sandstones, schists and shales, and much weathered, especially on Jemor. In contour the islands are steep-sided, with some almost sheer cliffs, and flat-topped. The highest of them, Jemor, rises to about seventy-five feet above sea level. It is nearly a mile long, three to five chains wide, and has an area of approximately three hundred acres. Near the centre it is cleft almost to sea level by a narrow gully, which connects two sandy beaches, one on the north-west, and the other on the south-east, side of the island. In the gully, and at the foot of the slopes flanking the island is a fairly rich vegetation of palms and trees, including *Terminalia catappa*, *Ilex macrophylla*, *Thespesia populnea*, *Eugenia* spp., and many mangrove species, such as *Rhizophora conjugata*, *R. mucronata*, *Lumnitzera littorea* and *Bruguiera gymnorrhiza*. Over the flattened summit the vegetation is more scanty, and in the exposed situations it is reduced to coarse and wiry sedge-like grasses, *Eriachne pallescens* and *Gahnia tristis*, with scattered clumps of *Melastoma* and a few stunted stands of pandanus. According to Robinson this is the only island in the group where there is a natural supply of freshwater, though even here it is "uncertain in quantity and indifferent in quality". Jemor has two attendant islets, one lying to the north and the other to the south-east.

South-west of Jemor, and separated from it by a slightly deeper channel, six to eight chains wide, is a line of five small islands, the Western Aroas.² They lie along a bank with depths of less than five fathoms, and at low tide considerable areas of rock and sand are exposed round and between them. In outline and vegetation the Western Aroas resemble Jemor.

¹ Pulau Jemor = *Djemoer* or *Jemur* in the Malacca Straits Pilot. The spellings used here follow Madoc, *supra*, not the Pilot. In this case the form *Jemor* occurs in Robinson (1907), Scrivenor (1916), and—so far as is known—all local references except Chasen & Kloss (1931), but *Jēmūr* (Malay, *jēmūr*, dried in the sun, as in preparing dried fish) is probably more correct. The description of the islands given here is based on the Malacca Strait Pilot (1946), Robinson (1907), Kloss in Scrivenor (1916) and Madoc (this journal, *supra*).

² From north to south the Western Aroas are Tokong Mas (104 ft.), P. Pasir Pandan (65 ft.), P. Sarang Lang (88 ft.), P. Labohan Bilek (65 ft.) and Tokong Si-Puchong. *Pulau Sarang Lang* = Hawk's Nest Island, *Pulau Labohan Bilek* = the island with the sheltered (closed-in) anchorage. *Tokong Si-Puchong* = Little-Green-Heron (*Butorides striatus*) Islet.



Sketch map showing the position of the Aroa Islands, and other islands in the Malacca Strait. Land above 750 feet shaded in half-tone; above 3,000 feet, in full tone.

The second group of islands, the South Aroas, lies six to seven miles south-east of Jemor. It consists of the island of Tokong Simbang,³ with several rocky islets and stacks close to it, and the barren islet of Pulau Tokong, one and a half miles away in a southerly direction. The South Aroas are partly of granite formation. Tokong Simbang and its two adjacent islets are conical and densely covered with vegetation except on the steeper slopes. Close to them are six small, sheer-sided stacks, supporting little beyond a fairly strong growth of *Morinda citrifolia*. Simbang itself rises to a height of 121 feet to the tops of the trees, and is the highest member of the whole group. The more sheltered parts are fairly well wooded. Pulau Tokong rises to a height of only thirty feet, and is entirely devoid of visible vegetation.

Fishermen from Siak sometimes visit Jemor for a few days at a time, to collect the turtles' eggs. Otherwise the group is wholly uninhabited. It is said to have been used in the early part of the last century as a retreat by the pirates from Linggi and Selangor, but it is far from clear how much the islands were really employed in this way. There are no good anchorages, and it would have been difficult to carry out any repairs there.

³ Tokong Simbang = Frigate-bird Islet. *Tokong* (Malay), a small island more than a mere rock, but not fit for human habitation: generally applied to barren stacks, and certainly to a Malay navigator implying an absence of fresh water (i.e. no drinking water, an important consideration).

The only recorded instance of supposedly pirate vessels being found off Jemor occurred in 1836, when H.M. Frigate *Harrier* sent a party ashore for water. While they were there they were surprised by the appearance of three armed *pérah*, which turned away when challenged. It was assumed that they were hostile, but it was suggested later, after their destruction, that they might have been peaceful traders hoping to anchor for the night.

The first recorded investigation of the fauna of the Aroas was undertaken by H. C. Robinson.⁴ He paid a short visit to Jemor at the beginning of August, 1906, and then returned for a longer stay in November of the same year. On the latter occasion he camped on Jemor, and there is no direct indication that he actually landed on any of the other islands. He reported the existence of a large rat,⁵ which he said was "very abundant" on Jemor, three lizards and a toad. His principal interest was in the avifauna. In all he and his collectors took examples of thirty-six birds, and he supplied visual records of the occurrence in the area of a further five species. Eight of these birds were probably breeding somewhere in the group: thirty-two are clearly passage migrants, and for the present we regard the thirty-third, a visual record of a crow, as indeterminate and possibly the Koel, which he also lists in its own right.

In his account of the collections, Robinson remarks that during his first visit in August, "with the exception of sea and shore birds, very few varieties were noted"; but during his second visit in November, "the island was frequented by many species on migration". An examination of his records and surviving material shows that only one of the passage migrants, *Ptilinopus jambu* (Gmelin), was taken in August; the remaining thirty-one were all taken or seen in November.

In February, 1915, C. Boden Kloss spent a few days on Jemor.⁶ During this time he also visited the Western Aroas, but he does not appear to have gone down to the South Aroas (though he was accompanied by the government steam yacht). The object of his visit was to trap further examples of the Pulau Jemor rat, and to obtain rock specimens for examination by the Geological Survey Dept. Kloss himself summarised the zoological side of his visit as follows,

The rat is the only terrestrial mammal and no bats were seen. No birds besides the common sea or shore species (and the few others which always occur in such situations) except a pitta (*P. cyanoptera*) and a rail (*A. phasianus*) were observed, the collection made being practically similar to that secured on the former visit in August, thus showing that the migration season which was at its height in November 1906 had come to an end. A day-flying mosquito was both numerous and active.

He also reported that he had found no coral round Jemor or the Western Aroas, and that "among the shrubs in flower in February was the pretty pale pink myrtle, *Cynomyrtus tomentosa*."

Actually Kloss's visit added one species, *Sterna hirundo*, to the birds reported from the group, bringing the total up to forty-one forms (or forty-two if one accepts Robinson's visual record of a crow). Unfortunately Kloss did not record any data on the sea

4. See Robinson, H. C., *Journ. Fed. Malay States Mus.*, 2, (1), 1907: 8-16. Here cited as Robinson, 1907. For illustrations of the island, see Kloss in Scrivenor, 1916. Seimund also paid a one-day visit on 27 July, 1907, when he collected 3 ♂♂ of *S.a. unicolor* but no examples of *S. dougalli*.

5. Subsequently described: *Rattus rattus jemur*, Chasen & Kloss, *Bull. Raffles Mus.*, 5, 1931: 78. Confined to the type locality, Jemor Island (rendered, probably more correctly, as Jemur Island by Chasen & Kloss). The toad was lost. The lizards were identified as *Varanus salvator*, *Mabuia multifasciata* and a gecko.

6. See note by Kloss in Scrivenor, *Journ. Fed. Malay States Mus.*, 6, (4), 1916: 253-4. This short paper is illustrated by eight excellent photographs of Pulau Jemor, taken by Kloss. They include a view showing his camp in the gully on Jemor, presumably Robinson's former camping ground also. These appear to be the only photographs of the island that have been published.

birds, or on any of the other species breeding there. Accordingly we learn little from his brief note beyond the fact that there was almost as little evidence of migrants in February, as there had been on Robinson's first visit at the beginning of August. So far as the sea birds were concerned, by the close of Kloss's visit we had the following information,

Sula leucogaster: believed to be breeding on "Pulau Tokong"; two adults taken at sea off that island by Seimund, working for Robinson, on 16 November, 1906.

Fregata, sp. indet.: "immense flocks seen round the islands" by Robinson; no other data.

Sterna hirundo: stray, passage migrant or winter visitor, taken once, February, 1915, but not mentioned in Kloss's note.

Sterna dougallii: "very abundant" in August, 1906, but not seen in November; believed to be nesting in the group; three specimens taken.

Sterna anathetus: "fairly abundant" in August, 1906; one specimen taken on 2 August, 1906; three on 27 July, 1907; no other data.

The four other species by then observed or collected that are believed to be breeding on the Aroas are,

Ardea sumatrana: a single specimen seen; no other data.

Butorides striatus: several specimens taken.

Demigretta sacra: very common; all examples seen or taken in the grey phase, and those in August in nuptial plumage.

Haliæetus leucogaster: seen; no other data.

In the following thirty years no further information was obtained, beyond statements of uncertain origin to the effect that *Sula leucogaster* and a frigate-bird were nesting in the South Aroas. It must, of course, be admitted that this was a reasonable enough assumption. Both *Sula leucogaster* and *Fregata ariel* have been reported or taken at intervals along the whole length of the Malayan coast from the Langkawi Islands to the vicinity of Pulau Pisang, and no other local breeding grounds were then known with certainty. In 1936 Chasen wrote, under the heading of *Sula leucogaster*,

This gannet is common in the Straits of Malacca, but does not approach the shores very closely except in stormy weather, and is therefore not a familiar bird to the ordinary resident. There is a breeding colony on a small rocky island in the Aroa group in mid-channel between the coasts of Sumatra and Selangor. When Robinson visited the Aroa Islands he found numbers roosting on a small rock known as Pulau Tokong, rising vertically from the sea to a height of forty or fifty feet; the entire colony, consisting of some hundreds, appeared to be adult birds. Davison reported the species as numerous the whole way up the western coast of the Peninsula, from Singapore to the Mergui Archipelago, but we have never seen a specimen anywhere near Singapore Island (in Robinson & Chasen, 1936: 242).⁷

Interestingly enough an unofficial report from a wartime air reconnaissance in August, 1945, referred to swarms of frigate-birds rising from a stack near Tokong Simbang, but made no mention of the presence there of *Sula leucogaster*.

⁷ As we have intimated, *Sula leucogaster* has been taken off Pulau Pisang; there is also a visual record for Singapore Island (D. W. Le Mare). Davison took a specimen off Cape Rachado (see Hume & Davison, 1878: 493, also critical comment in Gibson-Hill, 1950b: 17, footnote), but did not personally encounter the bird further south. *Fregata ariel* has also been taken near Pisang.

Subsequently, on 9 April, 1949, through the kindness of T. W. Burdon, I was able to accompany him on an investigation of Pulau Perak.* Our visit showed clearly that there was no indication of *Fregata ariel* breeding there, and that the terrain was wholly unsuited to its habits and requirements. We also discovered that there was on Pulau Perak a breeding colony of some 4,500 to 5,000 pairs of *Sula leucogaster* and, moreover, that laying apparently began in November or late October and ended for the season in January. This meant that there would be no reproductive activity in August or September. Assuming the same seasonal rhythm two hundred miles further south, this could be held to account for the apparent absence of the birds from the South Aroas (where they had been reported as present at unrecorded dates in the 1930's) in August/September 1945.

About the same period, G. C. Madoc made two short trips to the Aroas, with the object of adding precise information to our knowledge of the birds there. His first visit was on 23 June, and the second seven months later, on 12 January. A full account of the birds observed, together with an improved description of the flora of the islands, appears in a most useful paper immediately preceding this one (Madoc, *supra*: 150-4). Madoc again saw very few migrants, even in January, and he thus repeats Boden Kloss's observation of February, 1915. He also adds two birds hitherto not recorded for the islands, but probably resident there, *Ducula bicolor* and an unidentified sunbird. Finally, as we can see, he has provided extremely interesting data on the sea birds, some of which requires careful consideration. The present paper has been prepared with the object of assembling the records now available from all sources, and of analysing the present information on the sea birds of the group. For convenience the records are treated below under three headings, (1) Sea Birds, (2) Other species probably breeding in the group, and (3) Passage Migrants. This arrangement has been chosen because of the different quality of the comment possible in the three categories. Briefly we can summarise the points presented later as follows.

(1) **Sea Birds.** Seven species have now been recorded from the Aroas: their status there is probably as follows.

Sula dactylatra Lesson, subsp.: stray, recorded once (F. G. H. Allen).

Sula leucogaster plotus Forster: formerly bred in the South Aroas, but seemingly no longer present.

Fregata ariel ariel (G. R. Gray): resident, but breeding still not proven.

Sterna hirundo longipennis Nordmann: stray, possibly passage migrant or winter visitor, taken once (C. Boden Kloss).

Sterna dougallii korustes (Hume): breeding visitor, July to October, but nesting still not proven.

Sterna sumatrana sumatrana Raffles: breeding visitor, probably present May to September.

Sterna anathetus anathetus Scopoli: breeding visitor, probably present late May or June to September.

* Pulau Perak, see Gibson-Hill (1950: 1-4), Madoc (1954: 19-25) and Allen & Madoc (1956, in the press). I have not been able to find any early references to the presence of sea birds on Pulau Perak, but they were known to be there during the period 1920-40: captains of passenger vessels occasionally passed close to the island and with excessive stupidity sounded the ship's siren so that the passengers could have the immeasurable pleasure of seeing the frightened birds rise in the air.

(2) **Shore and Land Birds probably resident in the Aroas.** Six species as follows,*Ardea sumatrana sumatrana* Raffles.*Butorides striatus javanicus* (Horsfield).*Demigretta sacra* (Gmelin).*Halæetus leucogaster* (Gmelin).*Ducula bicolor* (Scopoli).

A sunbird (Nectariniidae), unidentified (see p. 174, below).

(3) **Passage Migrants.** Thirty-two species are listed, all recorded by Robinson, thirty-one in November, 1906, and one in August, 1906. No subsequent additions have been made to Robinson's list, except for the tern *Sterna hirundo longipennis*, but several of the species were subsequently recorded by Kloss or Madoc.

It is now clear from the various accounts that Robinson in November 1906 was the only ornithologist to visit the islands when the migrants were present in any numbers, and accordingly the list as it now stands may show some personal bias in regard to collecting. Nonetheless it is perhaps worth pointing out that of the thirty-two species which he records, six are members of the family Cuculidae, and three of the family Alcedinidae, while the Charadriidae are represented by only two forms, of which one, *Actitis hypoleucos*, turns up almost everywhere, and the whole of the passerine group of families by only nine species, less than a third of the total.

Section I

Notes on the Sea Birds recorded from the Aroa Islands

The numbers preceding the names of the birds are those given to them in the Malayan Checklist (1949). They are used here to facilitate cross-reference to that and other papers published from the Raffles Museum. The first species to be noticed here was not accorded a place on the Malayan list in 1949, and as indicated should be inserted between numbers 6 and 7.

Family SULIDAE

6/7. *Sula dactylatra* Lesson, subsp.

Masked Booby.

F. G. H. Allen had "a fleeting glimpse" of two Masked Boobies off the South Aroas on 23 June (see Madoc, *supra*: 151). We also now have two visual records from Pulau Perak. Two adults were seen resting together on a rock terrace near the summit of the island on 9 April, 1949. They remained long enough to be viewed for nearly a minute at a distance of about twenty feet (Gibson-Hill, 1950: 3). Subsequently, on 4 February, 1956, Allen and Madoc saw two adults together in a similar situation, and were able to obtain photographs of them: one of the birds on this occasion was apparently sitting on a single egg.⁹ *Sula dactylatra* might possibly be confused with *Sula sula rubripes*¹⁰ in

⁹ F. G. H. Allen, *in litt.*, 11 February, 1956. See also Allen & Madoc, *Malayan Nature Journal*, 10, 1956, in the press, cf. *Bull. Raffles Mus.*, 22, 1950, pl. 7.

¹⁰ *Sula sula rubripes* Gould. No breeding grounds are known in the Bay of Bengal, but this species nests on Gunong Api in the Banda Sea, in the Paracel group off the coast of Annam (Delacour & Jabouille, 1930: 16-7) and in the Sulu Sea (Worcester, 1911: 170). There is a visual record of an adult seen off the coast of Trengganu, erroneously reported as *Sula dactylatra* (Parry, 1954: 25). There are also doubtful visual records for the Bay of Bengal. Chasen (1935: 66) lists it from the north coast of Borneo, where it is a likely stray, but it has not been possible to trace the source of this record.

flight (though the wing pattern is distinctive), but standing it is clearly separable from every species hitherto recorded in, or anywhere near, the Malayan sub-region. There can be no doubt of the identity of the birds seen on Pulau Perak, and accordingly no grounds for querying the occurrence of this species off the Aroas.

These three records are of some interest, and together they provide us with a problem—the site of the colony where the birds were reared. Prior to 1949 there appears to have been only one certain record of this species from anywhere in the Bay of Bengal, or along either coast of the Malay Peninsula. This is an immature bird in the British Museum collection said to have been taken off the coast of Tenasserim. It is reported by Legge (1880: 1177), who calls it a not quite mature example of *Sula leucogaster*, but as his description shows, it is really an immature *Sula dactylatra*. The nearest recorded colonies are those on the island of North Keeling, in the Indian Ocean, where some forty to fifty pairs were breeding in 1941 (Gibson-Hill, 1950a: 231–4); and on Gunong Api, in the Banda Sea, where Hoogerwerf and van Bemmelen (1940: 447) found about 100–150 birds in 1938. This species has not been recorded from the Paracel Islands, in the South China Sea, or from any of the islands in the Sulu Sea.

In providing the formal heading to this note we have not indicated the subspecies, as no specimens have been examined. But from the information available on the distribution of *Sula dactylatra* in the Indian Ocean and adjacent seas these birds must almost certainly be *S. d. bedouti* Mathews. Only four colonies of this subspecies have hitherto been recorded, the two noted above (North Keeling and Gunong Api) and two on the north-west coast of Australia (the type locality and Adelie Island). The race of *Sula dactylatra* occurring in the western Indian Ocean, *S. d. melanops* Heuglin, sometimes nests on barren stacks, wholly devoid of vegetation and presenting the same physical environment as Pulau Perak. The four known colonies of *bedouti*, on the other hand, are situated on low sand-dunes or dry earth with a sparse, stunted covering of grass, but in no case on bare rock. We would, therefore, have expected to find these birds breeding in the Aroas, rather than on Pulau Perak.

It should be noted that the majority of the colonies of both *melanops* and *bedouti* are small, though in several cases they are in close proximity to much larger units of other members of the same genus. Seemingly then there is no shortage of food within flight range of the breeding grounds, and it is probable that this species is slowly dying out in this part of its range, without human assistance. In 1940 Hoogerwerf described *bedouti* as one of the least numerous of the sea birds on Gunong Api, with less than seventy-five breeding pairs, in contrast to the several hundred pairs of *rubripes*. In 1941 there were over 3,500 active pairs of the latter on North Keeling, and only forty to fifty pairs of *bedouti*. The largest colony of *bedouti* appears to be the one on Bedout Island itself, but unfortunately no figures are available. The fourth colony, on Adelie Island, is of doubtful standing, but there cannot be more than a few pairs present, if indeed these birds are still nesting there regularly. A somewhat similar situation appertains in the case of the western race, *Sula dactylatra melanops*.¹¹

The birds observed on Pulau Perak and off the Southern Aroas could be some of the few survivors of a dwindling colony. In which case the latter may conceivably have

11. Abbott's Booby, *Sula abbotti* Ridgway, has already disappeared from the western Indian Ocean (though this may well have been partly due to interference from the guano-collectors), and it now survives only in a colony of some 500–750 pairs on Christmas Island (Indian Ocean): see Gibson-Hill, 1950c. It seems doubtful if the total remaining populations of *Sula dactylatra melanops* and *S. d. bedouti* together amount to more than twice this number of pairs, and they are spread over ten or more distinct colonies. I am assuming in this that the birds in the Sulu Sea area are indeed *personata*, and not *bedouti*.

been situated originally in the Aroa group, and the birds have moved to Pulau Perak in company with the colony of *Sula leucogaster*, if indeed the latter did migrate (see below, p. 165). Further if such a move did occur, it might well have hastened the elimination of *dactylatra* from this area: Pulau Perak would not be unsuitable as a new home for some of the units of *melanops*, but it does not fit in with what we know of the preferences of *hedouti*. The objection to this suggestion is that though we have a number of formal and visual records of *leucogaster* from the Malacca Strait, *dactylatra* had never been reported from this area before 1949. The solitary immature example taken off the Tenasserim coast was found more than five hundred miles away: if it had strayed that far, there is no reason why it should not have trebled the distance and come from the colony on North Keeling. There are two records of *dactylatra* reaching the west coast of Ceylon, and on the evidence at present available the birds (one at least of which was immature) must have drifted more than fifteen hundred miles to get there.

It will have been noted that on each of the three occasions on which Masked Boobies have been seen in the Malacca Strait there have been two birds, both in full adult plumage. This does not necessarily prove that they have been the same two individuals each time, but they could well have been. If there is, in fact, only one pair present in the area it is more likely that they are birds which strayed into the Malacca Strait from the Java Sea or the Bay of Bengal, while immature, and on reaching maturity joined up with the colony of *leucogaster* on Pulau Perak. We know that birds from the latter colony occasionally drift at least as far south as the southern end of the Malacca Strait. Presumably they also travel northwards into the Bay of Bengal, as Davison reported this from Mergui southwards and no breeding ground has yet been located north of Pulau Perak. An attachment such as is postulated here has been known to occur among sea birds that habitually nest in colonies. An example of the Blackbrowed Albatross, *Diomedea melanophrys* Temminck, which found itself in the North Atlantic, joined the Gannets breeding on Myggenaes Holm, off the Faroes, in 1860 and remained with them, leaving the island each autumn and returning in the spring, until 1894, when it was finally shot by a collector. It proved to be a female, with fully developed ovaries, a detail which scarcely accorded with the views of the inhabitants of the islands, who called it the "King of the Gannets" (Murphy, 1936: 511).

Briefly, we can say that since it now appears that there is no longer a colony of *Sula leucogaster* on the Aroas, the two examples of *dactylatra* seen by F. G. H. Allen in June, 1951, were probably not breeding in the group. Further, on the evidence at present available it seems likely that there is only one pair of these birds in the Malacca Strait, and that they are strays from Gunong Api or North Keeling, which have joined the colony of *Sula leucogaster* on Pulau Perak. The normal clutch in this species is two, the second egg appearing five to seven days after the first one.¹² The fact that they were seen with a single egg this year does not necessarily mean that they are not able to breed successfully on Pulau Perak, though it would not be surprising if they found the rock too hot for satisfactory incubation, or for rearing the chick.

It is, of course, possible that the clutch was not complete at the time of Allen's visit to Pulau Perak, in spite of the fact that he describes the egg as "very battered looking" (*in litt.*, 11.2.56). One suggests this because although it was possible to photograph the

¹² Hoogerwerf (1940: 447) reporting observations on Gunong Api. In *Sula leucogaster plotus* on Christmas Island the second egg appeared seven to ten days after the first one, but these latter birds did not always lay two eggs. Two eggs is apparently the normal clutch for *dactylatra*: in *leucogaster* it may be one or two, but both birds very seldom rear more than one chick in a season.

two birds, they do not appear to have stood their ground with the tenacity which is usual when they have a full clutch. Murphy describes the reactions in this species very well, in his account of the colony on La Plata, on the coast of Ecuador,

Most of the nesting boobies were altogether fearless, although some of those having only one egg took flight at our too close approach. Those with a full set of two eggs were invariably ready to take the offensive as soon as we had come within reach, demonstrating once again the conditioning which is a concomitant of egg-laying. The birds trumpeted or whistled, according to their sex, and one of them succeeded in biting the finger of a member of our party sufficiently to draw blood. Frequently they revealed their troubled state merely by disgorging. One of them ejected a pile of seven flying fish, each 15 to 20 centimetres in length, which were practically as good as new and were immediately appropriated as bait by the lighthouse keeper of La Plata. This individual informed me that he and his son obtained all their bait for fishing by tickling the throats of these boobies with a switch. . . . (Murphy, 1936: 850-1).

One may add that the reaction appears to be less strong (certainly in the case of *leucogaster*) after incubation has progressed for a few weeks, and it then becomes heightened again when the chick emerges. The two birds seen on Pulau Perak might, therefore, have had an incomplete clutch, or they might have spent a long time coddling one egg.

7. *Sula leucogaster plotus* (Forster).

Brown Booby.

Robinson (1907: 11-2) says that in 1906,

Very large numbers of this gannet roosted on a small rock known as Pulau Tokong,¹³ rising vertically from the sea to a height of forty or fifty feet, some miles south-east of Pulau Jemur, where our main collections were formed. The entire colony, consisting of some hundreds, appeared to be adult birds.

Unfortunately he does not indicate whether this observation refers to both his visits, or only to the November one, but presumably it applies only to the latter. The Raffles Museum collection contains two examples of *leucogaster*, both in fully adult plumage, allegedly taken off Pulau Tokong on 16 November, 1906 (♂ 1857/07; ♀ 1858/07). Earlier Robinson tells us that he was unable to land on P. Tokong owing to the heavy surf (*loc. cit.*: 8), from which it seems likely, though not certain, that he only ventured down to the South Aroas on one occasion. Madoc (1947: 26) also says that the Brown Booby "breeds on the cliffs of one of the Aroa Islands—a paradise for the lover of sea-birds, sixty miles due west of Pulau Ketam, Selangor. There is a colony there, the members of which, when fishing, suffer much from the depredations of the robber Frigate-birds". Abbott collected an immature female of this species near the Aroas on 14 November, 1899, and another near Pulau Perak on 31 October, two years later (in Riley, 1938: 21). There are other old formal records for the Malacca Straits south of Pulau Perak, which taken together certainly suggest the presence of a colony somewhere within the Malacca Strait proper.

On the strength of these data, it has hitherto been assumed that there were two breeding grounds of this species in Malayan waters, Pulau Perak and Pulau Tokong, though it has always been clear that relatively little information was available about the

13. Pulau Tokong = *Toekong* (*Tekong*) of the Malacca Strait Pilot (1946: 165), where it is said to be thirty feet high. It lies 14 miles south-south-westward of Simbang (Lat. 2° 48'N., Long. 100° 39'E.) which is itself six miles south-eastward of Pulau Jemur. Tokong and Simbang (121 feet to the tops of the trees) are the major islets in the sub-group known as the South Aroas. As can be seen, Pulau Tokong is very much smaller than Tokong Simbang, which in addition is surrounded by several stacks and islets: as we shall suggest below, it is by no means certain that Robinson actually reached Pulau Tokong. His "Pulau Tokong" may, in fact, have been Simbang, or one of the stacks lying off it.

latter colony (Gibson-Hill, 1950b: 16-20). Madoc now reports that his party did not see a single example of *Sula leucogaster* in or near the Aroas on either of the two visits recorded above (*supra*: 151). He also adds,

Having inspected Tokong at close range and under ideal conditions, we all are convinced that this stack does not, and could not, support a breeding colony of *Sula leucogaster*. The steep surfaces afford no ledges, crevices or boulders on which the birds might lay their eggs. Equally, we are convinced that there is not a colony in any other part of the Aroa group. On two visits, almost exactly six months apart, we saw not a single bird of this species. Our experience is thus in striking contrast to that of the late H. C. Robinson.

In addition, we may note that this is in striking contrast to Madoc's observation in his *Introduction to Malayan Birds*, published in 1947.

There is unquestionably a large colony (probably amounting to some 5,000 pairs) breeding on Pulau Perak. It was first examined critically by T. W. Burdon and the present writer on 9 April, 1949: subsequently it was visited by Madoc and Molesworth on 10 January, 1954, and by Madoc again on 6 June, the same year. Short accounts of these visits appear in the *Malayan Nature Journal*, 5, (1), 1950, pp. 1-4, and 9, (1), 1954, pp. 19-24: the latter paper, by Madoc, is illustrated with excellent photographs of both *Sula leucogaster* and *Anous stolidus*. Madoc and Molesworth found a large number of Brown Boobies with eggs, but no chicks, on their visit in January, 1954, but apparently formed the opinion that laying was still continuing. On 9 April, 1949, we found no eggs or small chicks, and four out of five of the nest sites were empty: the youngest chicks were then three to four weeks old, and the great majority were nearly fully fledged (*loc. cit.*: 3 & pl. 2). On 6 June, 1954, Madoc found mostly birds in full juvenile plumage, with a few still bearing patches of white down and apparently unable to fly: he saw no younger chicks, and no eggs. Incubation in this species lasts approximately six weeks, and the full juvenile plumage (with power of flight) is attained by the time that the young bird is twelve to fourteen weeks old (see Gibson-Hill, 1947: 113-5).

In April, 1949, I formed the opinion that breeding was finishing on Pulau Perak for the year, and that laying might be said to run from October to the middle of January. Madoc's observations make it clear that in 1954, at least, the successful laying season was more restricted, and must have been confined to December and January, with perhaps a few late eggs in February. Also, as indicated, juveniles, some with a little down on them, must have been present through June, and the former on into July at least. Had the same sequence been occurring in the Aroas at the time of Madoc's two visits to the group, his party should have encountered sitting birds in January, and immature birds, a few still unable to fly, in June. This rhythm would also have fitted satisfactorily with Robinson's observations, irrespective of whether he saw only adults on the stack in August and November, or in November only, as the young birds might have been away from the colony by August. Unfortunately, as we have noted, Madoc and his party saw no examples of *Sula leucogaster* in January or June.

One point is clear: it would not have been possible for a colony of *leucogaster* to have descended on the South Aroas in February, and have bred and cleared away completely by June. On the other hand the birds could just have arrived in July, after Madoc's first visit, and been finished by January. But, and this is important, if the birds were following such a cycle on the Aroas, Robinson should have encountered juveniles, in full plumage and a few with a little down, in November, 1906. His report, as we have seen, records only adults; and the latter cannot in any light be confused with immature birds. Further, both his surviving specimens are fully adult, and we have no immature skins that could have been taken by his collector in November, 1906. Finally, if we accept this cycle, we have *Sula leucogaster* laying on the Aroas in July and August, and on

Pulau Perak, some two hundred miles further north, in December and January. There does not appear to be any external factor likely to be responsible for the difference in timing between the two cycles, and it is a most unlikely occurrence. In fact it seems clear, as I assumed in 1950, that if this species was breeding in the South Aroas in 1906, it was following the same rhythm as the colony on Pulau Perak.

This may well have been so in 1906, but clearly, on Madoc's evidence above, it was not the sequence of events at the time of his visits. If we still accept Robinson's observations (and there is no good reason to suppose that he invented his several hundred boobies, and obtained his skins elsewhere), we can only explain the information now available by postulating that these birds subsequently absented themselves from the Aroas arbitrarily, or, which is much more likely, that at some point in the forty odd years after 1906 the colony moved from the Aroas to join up with the birds on Pulau Perak.

Such a move might have occurred as a result of heavy bombing in the war, since Madoc's statement published in 1947 was presumably based on pre-war records. But it is interesting to note that records from R.A.F. attacks on colonies of the Northern Gannet, *Morus bassanus* (Linné) in British waters suggest that the survivors of strafing raids adhere fairly tenaciously to their accustomed sites.¹⁴ This certainly occurred in the case of Grassholm, off the coast of Pembrokeshire, and Scar Rocks off Wigtown (south-west Scotland),¹⁵ though the latter had only forty nests in 1945 and twenty-eight young birds in 1946 (C. E. Palmer, quoted in Gibson-Hill, 1947a: 124). Probably almost total extermination would be needed to clear a site, as in any one year there must be a small number of newly adult birds returning for the first time after an absence of several years.

The other possibility is that supplies of suitable fish became scarcer in the vicinity of the Aroas. This might have occurred, though there does not at present appear to be any evidence to suggest that there has been any great change of this nature. Finally, of course, we have to fall back on the assumption that the move was arbitrary but permanent. This is certainly more likely than arbitrary but temporary, and could be adduced as a reason for the disappearance of a colony of terns. We know also that the Northern Gannet formerly nested on Copinsay in the Orkneys, on the Stags of Broadhaven off County Mayo, and on Lundy off the coast of Devon: all three sites were abandoned during a period when this species was actually increasing in numbers and establishing new colonies. We have also records of species of *Sula* establishing new colonies, but little to suggest that they abandon old ones, unless there is a serious depletion in numbers over a wide area. If, in fact, this move could be authenticated more fully in the present case, where the bird does not seem to be disappearing from the area as a whole, we should have a most interesting record. Unfortunately, of course, we have no indication of the size of the population on Pulau Perak prior to the visit of 1949, and hence we cannot point to any period when there was a steep increase in numbers there. Similarly we have no dated observations on the birds on the Aroas between 1906 and 1950.

14. cf Fisher & Lockley, 1954: 204—"The gannet and the pelican are extremely tenacious of their breeding sites; many of the gannetries have been known to be occupied for hundreds of years and doubtless some have been occupied for a thousand or more. The colony on Lundy was known to be occupied from 1274 to 1909; that on the Bass Rock has been known since 1447, on Ailsa Craig since 1526, on St Kilda since 1696, on Sula Sgeir since 1549, on the Westermann Islands since about 1687, on the Bird Rocks in the Gulf of St Lawrence since 1534".

15. The colony on Scar Rocks is a recent one. Two pairs nested there in 1883, but the birds do not appear to have attempted to repeat the performance. The present colony dates from 1939, when a pair bred successfully for the first time.

In making the foregoing comments, as already indicated, we have accepted Robinson's statement that several hundred adults of *Sula leucogaster* were roosting in the South Aroas when he visited the group. But from the information available it is by no means certain that he ever reached Pulau Tokong. He makes no mention of Tokong Simbang, and refers to Pulau Tokong as being "some miles south-east of Pulau Jemor". If he had, in fact, sailed from Pulau Jemor to Pulau Tokong he would almost certainly have passed close to Tokong Simbang, to examine it also, particularly as the swell prevented a landing on the island that he was trying to reach. Under such circumstances one would have expected him to describe Pulau Tokong as "a mile or two south of Tokong Simbang", and to have made some reference to what he was able to see of the latter island.

With this point in view, it seems likely that in 1906 *leucogaster* was breeding on one or more of the stacks lying off Tokong Simbang, and not on Pulau Tokong. It must be appreciated that this bird is prepared to nest in a wide range of situations. Murphy, reviewing the nest sites selected by colonies of the typical race, which inhabits the tropical Atlantic and adjacent seas, says,

... The nature of the ground appears to be of relatively little importance to the birds, although a bit of altitude, a slope, or proximity to some sort of jumping-off place confer sufficient advantage so that they [the nest sites] appear to be more or less consciously selected. Vegetation is no detriment, provided it is neither dense nor high enough to interfere with take-off and landing. The breeding grounds therefore vary between terrains which are little more than bare, damp stone, as at St Paul Rocks, or sun-baked guano, as at Boatswain-bird Islet, and the sandy stretches of Bahaman cays which are covered more or less thickly with wire-grass, prickly pear, and sea-grape, *Coccolobis uvifera* (Murphy, 1936: 857).

According to Audubon, writing of a colony which formerly existed on the Dry Tortugas, "The nest of the booby is placed on the top of a bush, at a height of four to ten feet. It is large and flat, formed of a few dry sticks, covered and matted with sea weeds in great quantity" (in Bent, 1922: 201). The Colombian race of this species, *S. l. etesiaca* Thayer & Bangs, nests "in slight hollows amid grass and rocks on the steep, dripping slopes" of Cocos Island, off the west coast of South America (Murphy, *op. cit.*: 861). Hallinan (1924: 306) again found these birds breeding on rocky shelves among shrubbery and cactus on Taboquilla Island, off Panama. Wetmore describes *Sula leucogaster* occupying a similar habitat on the island of Desecho (off the west coast of Porto Rico), whose steep slopes support "a considerable growth of vegetation, bound with thorny creepers into an impassible jungle, with only small grass-grown openings offering a pathway" (in Bent, 1922: 203). On Christmas Island, in the Indian Ocean, *S. l. plotus* (Forster), the present race, nests mostly on or near the summit of the sea cliffs, but some birds were found breeding under the shelter of the vegetation backing the beaches, and others on ledges on the inland cliff.

The size of the nest varies considerably. It may be as much as five or six inches high, and over three feet across at the base, or it may consist only of a lining to a shallow depression scraped in the ground. The materials used are dried twigs and dead leaves, frequently from the cabbage-tree. It is usually placed in the open on the edge of the sea cliff, or if it is steep, the inland cliff, but it may be hidden in amongst the limestone pinnacles (Gibson-Hill, 1947: 113).

When, in short, we consider the catholic tastes of *Sula leucogaster*, it is clearly not impossible that these birds were responsible for the old nests—"largely shallow depressions in the soil and rubbish caught up at the angle between some tree trunks and the rock from which they sprung"—which Molesworth found while "clambering about one of the sheer stacks" off Tokong Simbang (Madoc, *supra*:). From the description they sound too closely encompassed by vegetation to have been made by frigate-birds, but they could fit *Sula leucogaster*, as observed on Christmas Island—or even the Red-tailed Tropic-bird, *Phaethon rubricauda* Boddaert.

Order FREGATIDAE

11. *Fregata ariel ariel* (G. R. Gray).

Least Frigate-bird.

Robinson, who uses the name *Fregata aquila* (Linné),¹⁶ says that in 1906 "Immense flocks of frigate-birds were met with round the islands, but none could be obtained" (Robinson, 1907: 12). It should be noted that he does not claim that the birds were nesting there on either of his visits. On the other hand, Madoc's statement that members of the colony of *Sula leucogaster* on Tokong "suffer much from the depredations of the robber Frigate-birds" (Madoc, 1947: 26), strongly suggests breeding somewhere in the group. *Fregata ariel*, like the skuas, normally obtains much of its food direct from the sea or shore, and only parasitizes its neighbours during the breeding season, when the adults require additional supplies, at frequent intervals, to satisfy the demands of their chicks.

Madoc (*supra*: 151-2) found frigate-birds roosting in the South Aroas in both January and June. Three birds were shot on the January visit, one of which is said to have contained a single "shell-less oviduct egg . . . about full size". The egg was not preserved, but the skins were sent down to the Raffles Museum for identification. They were unquestionably adults of *Fregata ariel*, in full breeding plumage (♂ ♂ 2, ♀ 1): the two males had well developed brick-red gular pouches, and were probably just past the peak of sexual activity for the year. From the description of the egg, and the condition of the pouches in the two males, there can be no doubt that these birds should have begun the desultory nest-building which occurs in this genus.

The birds were apparently roosting on one or more of the precipitous stacks near Tokong Simbang (in January "particularly . . . the most westerly one"). While the boat was still approaching the island, they rose into the air, and after spiralling upwards disappeared in a northerly direction. "On both occasions, as we sailed east from Pulau Jemor in the evening, considerable numbers of Frigate-birds appeared from the north, singly and in small parties. They were flying high, leisurely, and direct from the north towards the Southern Aroas". There can be little doubt that, as Madoc suggests, the birds were making for feeding grounds somewhere to the north of the Aroas at dawn, and returning thence at dusk, to spend the night in the vicinity of Tokong Simbang. In this context it is interesting to note that a frigate-bird, almost certainly *ariel* again, has been reported from Pulau Bērhalā, a small island with two attendant islets, situated off the Sumatran coast, about fifty miles due east of Bēlawān (the port for Medan), and just over a hundred miles north-west of the Aroas.¹⁷ "According to the Malay fishermen (on P. Bērhalā) the frigate-birds roost on the small islet north of the main island" (Mohr, 1930: 286). There is no suggestion of their nesting in the group, and unfortunately it is not clear whether or not the birds are present all through the year. Presumably there is a fishing ground attractive to *Fregata ariel* somewhere within range of these two islands, but a study of the Admiralty charts does not give any clue as to what or where it might be. Assuming that birds from both islands are working the same area, it must

16. *Fregata aquila* (Linné) is confined to Ascension Island, in the Atlantic, but there was considerable confusion in the nomenclature of the frigate-birds prior to the publication of the revisions of the genus by Mathews (1914) and Lowe (1924), and the term *Fregata aquila* was not infrequently applied to *F. ariel*: for a note on the effects of this confusion on the records from the Indian Ocean, see Gibson-Hill, 1953: 95-6.

17. Pulau Bērhalā, 581 feet high, thickly covered with vegetation. A wooded islet (Lat. 3° 46' N., Long. 99° 30' E.), 151 feet high, lies 150 yards from its south-eastern point: about half a mile north-westward of the main island is a similar rocky islet, 141 feet high (Malacca Strait Pilot, 1946: 79). For a summary of the avifauna, see this journal, 24, 1952: 336-43. Original papers by J. C. van der Meer Mohr, 1927, 1928 & 1930 (*Treubia*, 12, (3-4): 277-98).

be south of Pulau Bérhala, and north of the Aroas. There do not appear to be any records of the feeding range of this species: on the Cocos-Keeling Islands the birds generally travelled about three to five miles from North Keeling to their fishing grounds, but a small number often came as far as the north side of the main atoll, a distance of fifteen miles. It is unfortunate that the three specimens collected on the Aroas were taken in the morning, and not in the evening: in the latter case we might at least have known what it was they were feeding on, even if we could not be sure where they were going to get it.

In January, while clambering about on the most westerly of the stacks off Tokong Simbang Molesworth "found plentiful droppings and the typical smell of frigate-birds". In June of the previous year Madoc had noted many signs of roosting on this or an adjacent stack, particularly in the gnarled trees of *Morinda citrifolia*,¹⁸ but no nests attributable to *Fregata ariel* were seen on either occasion. There can be no doubt that the frigate-birds lack the ability attributed to *Halcyon* of laying their eggs successfully on a raft of foam floating on the surface of the sea. Equally the birds must be disposing of them somewhere. The situation must be faced with courage. On neither visit to the Aroas did Madoc see any frigate-birds in the vicinity of the Western Aroas, or find any evidence of their quondam presence there. If, therefore, they are not nesting somewhere in the South Aroas, where are they nesting?

Frigate-birds are extremely cautious in their approach to land and water; and behave as if they viewed things solid and liquid with a certain misgiving.¹⁹ Essentially the air is their medium, probably more so than any other group of birds. Lying out at sea off the north side of Christmas Island, one could gauge the passage of a sharp burst of wind along the coast by watching the frigate-birds rising successively from each colony, as the first breaths reached them. If trouble were coming, they preferred to meet it in the air. On stormy days, with the grey clouds rushing overhead, they were always on the wing, idling high above the swaying trees, slowly making their way into the wind with motionless wings, as though, like the Polish Faust, they were condemned to remain suspended half way between heaven and earth until the world ended.

With these reactions frigate-birds are reluctant to alight in any but a well-known spot. They normally roost all through the year at, or close to, the trees or bushes in which they breed, though contrary behaviour has been recorded in the Seychelles group. Here, apparently, some of the colonies maintain breeding and non-breeding quarters. Thus frigate-birds from Aldabra and Cosmoledo establish themselves among nesting colonies of terns and *Sula dactylatra* in the Amirante and Seychelles Archipelagos, when not breeding themselves (Vesey-Fitzgerald, 1941: 531): so also Betts (1940: 500),

Both these species [*Fregata minor aldabrensis* Mathews & *F. ariel iredalei* Mathews] occur in the Seychelles and breed on Aldabra. One occasionally sees them at Mahé, soaring at a great height over head, or roosting on the rocky islets off the coast. Both species are found at Aride, though they do not breed there. On my first visit there were only a few, but with the incoming of the Sooty Terns the numbers of the Frigates increased, and when I left at least fifty could be seen soaring on high of an evening. There were two roosts, one in some coconut palms on the south-east slope, and the other on the scrubby trees halfway down the precipitous cliff on the north.

It seems likely also that the frigate-birds seen in the neighbourhood of Tioman, off the east coast of Pahang, this time *Fregata andrewsi* Mathews, are visitors from the Anamba

18. *Morinda citrifolia* Linné, the *Mengkudu* or Great Morinda, a small evergreen tree, up to 25 feet high, with large, broadly elliptic leaves and a pale grey-brown bark: common on rocky or sandy sea coasts in Malaya.

19. There does not appear to be a single authenticated reference to a frigate-bird voluntarily alighting on the water, or swimming or floating, and if forcibly immersed their feathers rapidly become water-logged.

Islands. But in this latter case birds have never been encountered in full breeding plumage, and there appears, in fact, to be a high proportion of immature birds among them.

Courtship takes place at the nest site, and presumably the three birds collected by Madoc had been, and probably still were, indulging in mating displays. In the Lesser Frigate-bird, *Fregata m. minor* (Gmelin) on Christmas Island, the adults begin displaying about the end of December or early in January. Desultory nest building starts towards the end of the latter month, and the single eggs are normally laid in February, March or April. Chicks in down can be found during the latter month, and from then on until July. The young birds are ready to fly (though at first reluctant to do so) when they are twenty to twenty-two weeks old. The earliest of the season's youngsters are on the wing by the end of July. The majority go up in August or September, and the adults undergo a full moult between the end of September and the end of the year.

Fregata ariel is slightly smaller than *F. minor*, and the growth of the chick may be more rapid, but the difference cannot amount to much. From the beginning of the displaying period to the time when the young birds leave the nest must certainly take at least seven months, and probably about eight months. If the three specimens collected by Madoc on 12 January were representative of the colony, the birds should have had chicks roughly three-quarters fledged by the end of June. That is to say by the latter date the nests should have been rendered conspicuous by their occupants. At the same time there might have been comparatively little to see by the middle of August, except for a number of apparently fully-fledged juveniles (though actually many would still have some down on the underparts) perched sleepily at or near the nests. But we do not, of course, know that Robinson visited Tokong Simbang in August. In November there would be little for him to see. The puzzling point is that Madoc and his party saw no signs of breeding activity on their June visit. In addition neither Madoc nor Robinson mention seeing any juvenile (pale-headed) birds among those which they watched in the air. It is clear, of course, that in some cases the latter drift away from the colony, but there are generally a few about.

The next point is the question of the nest itself. It is not usually a large structure in the frigate-birds, and brooding or unengaged birds devote much time to stealing pieces from those of their neighbours. But the sticks and twigs that do survive until the chick is three to four weeks old are generally retained, cemented into position by its excreta, until the end of the breeding season. In *andrewsi*, the core of the nest survives from year to year in this form, but in *ariel* on the Cocos-Keeling Islands there is little left by the time that the adults want to use it again. As in the case of *Sula leucogaster* above, the nest in this species certainly varies considerably in size and quality from colony to colony, depending on how much material is available to the birds. The adults of *Sula leucogaster* scrape and tug at anything round them to add it to their mound: and on sites like Pulau Perak will make do with only half a dozen pebbles and a few remiges and rectrices left lying about from the previous season's moult.

The frigate-birds obtain most of their nesting material by breaking dead branch-lets or twigs off trees or bushes as they glide past them. They will also pick up suitable material from the surface of the sea, or from empty beaches, though they appear to be much better at obtaining live rather than dead objects this way. It is possible that there is a genuine shortage of available material in the South Aroas, and accordingly the nests there may be small. Simmons found the Atlantic race of this species, *F. a. trinitatis* Ribeiro, breeding on South Trinidad, the eggs being laid and the chick reared on the fallen trunks of Brazilwood Trees, *Caesalpinia* sp., with only a handful of twigs to serve as nesting material (Simmons, 1927: 27). On North Keeling the nests were a

little more substantial: here the birds were breeding in a great spread of *Pemphis acicula*, some three to four feet from the ground. On Mahlosmadulu Island, in the Maldives, *F. ariel* nests in the tops of tall trees, *Calophyllum inophyllum* and *Terminalia catappa*, the Sea Almond, and here they build much more substantial nests, so that the colony appears like an immense rookery (Gardiner, 1903: 369). On the coast of north-western Australia, they again build a "small flat nest of sticks on the top of a [*Pemphis*] bush" (Serventy & Whittell, 1948: 110). On Aibat Island, off the Somali coast, *ariel* builds large, clumsily made structures of sticks "just above the ground and the high water mark on low bushes or tussocks" (Archer & Godman, 1937: 33).

We can see from these notes that it is not an easy matter to determine either the size or position of the nests that *F. ariel* is likely to be building here, but it is extremely probable that they are breeding at or very close to the localities where they have been found to be roosting. From the length of the reproductive cycle it is clear that if the birds were, in fact, nesting in some other locality they would not have been observed at the South Aroas in January and June. Further since they are apparently travelling away from the island to feed, they cannot have been drawn to it, as in the instance recorded from the Seychelles, in the hope of living without undue labour during the interval between breeding seasons.

Family LARIDAE

151. *Sterna hirundo longipennis* Nordmann.

Eastern Common Tern.

An immature example of this bird was taken by one of Boden Kloss's collectors in February, 1915: the skin is now in the Raffles Museum collection. This species is largely a winter visitor to the Malacca Strait, but some birds also pass through this region to areas further south. The great majority of the records lie between September and April, but we have one bird taken at the end of July, and another taken off Penang on 27 May: probably a few spend their first summer here. In general The Eastern Common Tern keeps to bluer water, nearer to the centre of the Malacca Strait, than the other species wintering here. It is accordingly known from Jarak, the Aroas and the One Fathom Bank Lighthouse. It has also been reported from the Sembilan Islands and Pulau Angsa,²⁰ but not Pulau Pisang, nor is it yet known to penetrate far into the Singapore Strait. In a coastal voyage up the Malacca Strait at the beginning of April, 1949, we encountered a small number of these terns about ten miles south-west of Pulau Pisang, and then did not see any again until we were running up over deeper water south-west of Pangkor.

(152). *Sterna dougallii korustes* (Hume).

Burmese Roseate Tern.

Robinson found this species "very abundant" at the beginning of August, 1906, and, as we shall note, more plentiful than *Sterna anathetus*. He did not, apparently, discover any nests, as he says "Probably breeding on some of the smaller islands of the group" (Robinson, 1907: 10). Seimund shot three adult males in full breeding plumage for him on Pulau Jemor on 2 August: two of these skins are now in the Raffles Museum collection, and Robinson's identification of them (except in the matter of subspecies) is undoubtedly correct. In November Robinson failed to find "a single tern of any kind" in the neighbourhood of the islands.

Madoc says that his party saw no Roseate Terns on either of their visits to the Aroas, in spite of the fact that on 23 June they "visited, or passed close to, all islets,

²⁰ In addition Davison is said to have taken an immature example at *Salangore*, presumably this means off Kuala Selangor, and it might, therefore, also have come from Pulau Angsa. The skin was in the Hume collection (British Museum catalogue, Saunders, 25, 1896: 67).

stacks and skerries where terns might breed" (Madoc, *supra*: 153). It might be inferred from this observation that these birds have abandoned the group, as a breeding ground, since 1906. Actually we require more information before we can safely reach this conclusion. When attempting to assess the breeding seasons of sea birds in Malayan waters in 1950, I suggested that this species was probably laying in the Aroas in or about June.

On the evidence provided by Madoc the time of laying should probably be changed to August, and a second visit in the latter month now seems desirable. Hoogerwerf (1949: 64) records the eastern race of this bird, *S. d. bangsi*, Mathews, breeding off western Java with eggs in April and May. From information received from W. W. A. Phillips (*in litt.*, 15.9.50) it seems that in the colonies of *korustes* on the coast of Ceylon laying is spread over a period of about ten weeks, with the greater part of it taking place in the second half of April, and during the following month. In 1924 Phillips found the birds in a fairly large colony on a rocky islet off Ambalangoda (Galle District) beginning to lay as early as 6 April: the great majority of the clutches were then incomplete. On 5 May (1932) the same islet was visited by Felsinger, who found over two thousand pairs breeding there: the eggs, nearly always c/2, occasionally c/1 and c/3, were mostly fresh, but a few were hard set. On the other hand Hume's comments on the behaviour of *korustes* in the Andaman Islands suggests that their egg-laying is delayed until July, or possibly early August, though he records birds taken from April onwards (Hume, 1874: 294).

On 12 July, 1948, I found about a dozen Roseate Terns nesting in a mixed colony of about two hundred pairs of *Sterna anathetus* and a hundred pairs of *S. sumatrana* on Pulau Yu, off the east coast of Johore. Subsequently, on 27 July, we passed close to Tokong Burong, north of Pulau Tenggol (off the coast of Trengganu), but we were not able to effect a landing owing to the strong north-easterly swell that was running at the time. There appeared then to be about fifty pairs of *sumatrana* and a hundred pairs of *anathetus* on the islet, and with them seventy to eighty Roseate Terns. A. E. Coope took a clutch of two eggs of the latter from Tokong Burong on 29 July (1938). There are only these two colonies so far reported from the east coast of Malaya, and on the data available in 1950 it seemed likely that laying occurred in July, an assumption strengthened by the fact that the weather begins to break in this area in September. Subsequently, however, I visited Pulau Yu late in August (1952), and then found *S. dougallii bangsi* appreciably more plentiful (some sixty to eighty pairs), and with a number of clutches still relatively fresh. This late laying could well be due to enforced second laying, as a result of the depredations of the men from Pulau Tinggi, who raid the colonies of *anathetus* on these islets when opportunity permits. It is, however, also possible that the peak of the laying period in *dougallii* in Malayan waters occurs as late as August, or from the end of July through August.

If these birds do normally lay here between the latter part of July and the end of August, it is not surprising that Madoc's party saw no examples of *korustes* at the Aroas during their short visit on 23 June. In Britain and North America *dougallii* reaches its breeding grounds rather later than the other terns, and the birds are usually in a position to begin incubating within two or three weeks of their arrival. It is true that Hume's comments on specimens collected in the Andaman Islands indicate that *korustes* is present there from April onwards, though breeding does not apparently begin until July, but we must also bear in mind the notes provided by Madoc and Williamson on the small colonies in the Gulf of Siam. The presence of this species in the Inner Gulf was first reported by Williamson, who in 1916 took one bird from a pair seen flying over an islet near Kok Rin on 17 or 18 July (Williamson, 1916: 63). In 1949 Madoc discovered

four pairs on Kok Hin Chalarm on 11 July: they had established a compact little colony in a small area of bedrock and boulders at one end of the island, and there he found two eggs "in the last stages of incubation", and a single chick about two feet away. On 22 July, the same year, his collector paid a second visit to the island, and then found five clutches (2c/2 and 3c/1): all the eggs were fresh except for one of the single ones, which was on the point of hatching (Madoc, 1950: 164-5). At the same time both Williamson and Madoc had collectors on islands in the Gulf of Siam in May and June, in different years, and neither received notice of the presence of *dougallii* in these months. Finally we may remark that so far as the Aroas are concerned, August would be a more satisfactory time for laying than earlier in the year: and it would still be possible for the birds to be away by the middle of November. On the whole, as we have said, it seems likely that our original diagnosis was wrong, and that *Sterna dougallii korustes* lays here in August, and not in June, as we suggested in 1950.

It may perhaps be desirable to point out that Chasen (1935) records these birds as *Sterna dougallii bangsi*, but they must, I think, be assigned to *S. d. korustes* (Hume), as we have done here. Their bills are a shade longer than those of two fine examples of *bangsi* from Horsburgh Lighthouse, but they are clearly much weaker and more slender. The presumed breeding range of *korustes* as given by Peters (1934: 335) is Ceylon, the Andaman Islands and the islands of the Mergui Archipelago: "the Aroa Islands" should be added to this list, and deleted from the range of *bangsi*. It seems likely that this bird also reaches the west coast of Malaya, and there are unconfirmed visual records for Penang Island, but we still lack a reliable record of its occurrence in Malayan waters, and accordingly the number has been shown in brackets at the beginning of this note. The Roseate Tern on the Malayan Checklist remains *S. d. bangsi* Mathews, which, as noted above, is known to breed on Pulau Yu, off the east coast of Johore, and Tokong Burong, north of Pulau Tenggol, off the coast of Trengganu:²¹ it has also occurred at the eastern end of the Singapore Strait.

153. *Sterna sumatrana sumatrana* Raffles.

Blacknaped Tern.

Madoc's party saw small numbers of these birds at two points in the Western Aroas (Tokong Si-Puchong and off Pulau Labohan Bilek) and at the south end of Pulau Jemor, on 23 June (Madoc, *supra*: 153). No landing was made at any of these places, and accordingly we have no evidence as to whether or not this species is breeding there. It is, however, significant that this is the first occasion on which *sumatrana* has been reported from the group, and the date lies near to the centre of the laying period in the Malacca Strait area (see Gibson-Hill, 1950b: 28-9). On the whole it is reasonable to assume that *sumatrana* is, in fact, nesting in small numbers in the group. In which case a few birds should have been present at the beginning of August, 1906, when Robinson paid his first visit to Pulau Jemor, but he may well have overlooked them. The Blacknaped Tern apparently abandons at least some of its more exposed nesting sites outside the breeding season, though it can generally be found near rocky coasts on the mainland throughout the year. Robinson states positively that he saw no terns round the Aroas in November, 1906, and Madoc's party report none for 12 January, 1951. These negative records are not, of course, incompatible with the presence of this species as a breeding visitor from about May to July or August, and it is now assumed that it has this status.

²¹ For a fuller account of these colonies, see this journal, 23, 1950: 21-24. Inadvertently the name *bangsi* has been used on two occasions in that paper instead of *korustes* (Hume). On page 13, fifth line of the left hand column of the caption to the table of egg dates, for *S. dougallii bangsi* read *S. dougallii korustes*. And again on page 22, first line of footnote 1, for *bangsi* read *korustes*.

154. *Sterna anæthetus anæthetus* Scopoli.

Bridled Tern.

Robinson reports this species as "fairly abundant in August, but not so common as the Roseate Tern". On June 23, Madoc's party found it breeding in great numbers on Tokong Simbang (on which a landing was made), and apparently on all the nearby stacks: they estimated that in all there were as many as a thousand pairs nesting in the South Aroas that year. They also saw "large numbers" of this bird on Tokong Si-Puchong, in the Western Aroas, and were confident that it was nesting there also, though no landing was made on the stack. Robinson apparently landed only on Pulau Jemor on both his visits, and there is no direct evidence that he ventured down to the South Aroas in August. His assessment of the relative numbers of the terns present in 1906 was, therefore, almost certainly based on birds seen from Pulau Jemor, with possibly an additional boat trip round the Western Aroas. He may well have been unaware of any large colony of *anæthetus* on or around Tokong Simbang. It is, however, interesting that he considered *dougallii* more plentiful than *anæthetus* in the vicinity of P. Jemor, as the former usually breeds in small units.

Sterna anæthetus abandons its nesting grounds outside the breeding season, and one would not have expected it to be present in November or January. On the evidence at present available it appears that the normal laying season in Malayan waters runs from the end of May to about the middle of July, with a peak period in the second and third weeks of June (see Gibson-Hill, 1950b: 36). No examples of this species were seen in the immediate vicinity of the Sembilan Islands early in April, 1949, though a number had been encountered further south on the same voyage. Similarly it was not present on or near Pulau Perak on 9 April of the same year. Madoc, however, found four pairs (but no eggs) on the latter island on 6 June, 1954 (Madoc, 1954: 23), and the earliest recorded dates for eggs in the Sembilan group are 8 and 9 June (Allen & Berwick, 1950: 33).

Allen & Berwick (*loc. cit.*) suggest a later laying in the Sembilan group, but they may be recording replacements, as it is clear that the nests there are robbed by local fishermen, as they are in the Johore-Pahang archipelago. The only point that we have to consider is whether or not it is likely that a proportion of the birds breeding on the Aroas have normally finished by the end of July, and left the islands for the open sea. On the whole this seems unlikely, and though it now appears that *dougallii* does lay later here than *anæthetus* (discounting replacements), the difference in dates cannot really be advanced to account for Robinson's observation that the former was more plentiful than the latter in August, 1906. Either *dougallii* reaches the Aroas in considerable numbers in July, or the localities examined (from the sea) by Robinson did not provide a fair sample of the breeding grounds in the area as a whole. Madoc is admirably explicit on the points visited and examined during his two trips to the islands: it is unfortunate that Robinson did not exhibit an equal courtesy to those who might subsequently wish to make further use of his observations.

Section 2

Land and Shore Birds probably breeding on the Aroa Islands

When analysing the avifauna of Pulau Jarak, and comparing it with those of the other islands in the Malacca Strait,²² it seemed likely that four of the species other than

22. For analyses of the avifauna of other islands in the Malacca and Singapore Straits see Gibson-Hill, *Bull. Raffles Mus.*, 23 (1950) and 24 (1952), namely Pulau Jarak & other islands (1950: 263-99), Pulau-pulau Sĕnang, Pawai & Sudong (1952: 294-321), Pulau Pisang (1952: 326-36) Pulau Bĕrhala, with references to Rumbia & Paya (1952: 336-43).

sea birds recorded from the Aroa Islands were breeding there. The data collected by Madoc adds another two possibles to this list. As in section 1, above, the names of the birds are preceded here by the Malayan Checklist numbers.

Family ARDEIDAE

12. *Ardea sumatrana sumatrana* Raffles.

Dusky-Grey Heron.

"A single specimen was seen, but not procured" by Robinson: no other details. Also recorded from the Sembilan Islands.

15a. *Butorides striatus javanicus* (Horsfield).

Little Green Heron.

Several specimens were collected by Robinson. Also recorded from Pulau Jarak, the Sembilan Islands, One Fathom Bank and Pulau Pisang.

22. *Demigretta sacra* (Gmelin).

Reef Heron.

"Very common. All the specimens shot or seen were in the grey phase and those obtained in August were in nuptial plumage" (Robinson). According to Madoc, "Considerable numbers of these birds were seen, both in the Southern and Western groups and also on the shores of Pulau Jemor. All were in the grey phase of plumage . . . the number of these birds, in relation to the size of the islets comprising the Aroa group, is greater than in any other islands in these waters". Also recorded from Pulau Jarak, the Sembilan Islands and Pulau Pisang.

Family ACCIPITRIDAE

60. *Haliaeetus leucogaster* (Gmelin).

Whitebellied Sea-Eagle.

"Seen, but not secured" (Robinson). According to Madoc two birds of this species were seen on Tokong Simbang on both his visits to the island; in January he also saw a pair on an islet to the east of Pulau Jemor, perched close to a large nest of sticks, built in a fairly small tree. Also recorded from Pulau Jarak, the Sembilan Islands and Pulau Pisang.

Family COLUMBIDAE

170. *Ducula bicolor* (Scopoli).

Pied Imperial Pigeon.

Not recorded by Robinson. Madoc says that a few birds were present in the trees on Tokong Simbang on both his visits to the island. Probably this species occurs only on the South Aroas. Robinson's collectors could hardly have missed it if it were present on Pulau Jemor in 1906. Also reported from Pulau Jarak, the Sembilan Islands and Pulau Pisang.

Family NECTARINIIDAE

According to Madoc his party saw a few sunbirds on Pulau Sarang Lang in June, but were not able to approach close enough to identify the species. Robinson did not record any representatives of this family, but 541a, the Yellowbreasted Sunbird, *Leptocoma jugularis microleuca* (Oberholser), occurs on Pulau Jarak, the Sembilan Islands and Pulau Pisang: it is also the only sunbird to have been reported from any of these islands, and accordingly it seems likely that it is the species present on Pulau Sarang Lang. It is, perhaps, a little strange that it has not been seen on Pulau Jemor, and presumably it was not present on that island in 1906: again, Robinson's collectors are not likely to have overlooked it, if it were present in reasonable numbers, but there is no indication that they landed on Pulau Lang Sarang.

Section 3

Passage Migrants recorded from the Aroa Islands

Robinson records thirty-two species (listed below) which were apparently passage migrants: all the specimens still in the Raffles Museum collection were taken during his visit in November, 1906. Scrivenor (1916: 253) says very few migrants were present in February, 1915, and he mentions only two, *Amaurornis phaeicurus* and *Pitta brachyura*, both of which had already been reported by Robinson: in addition one of the collectors with him obtained the specimen of *Sterna hirundo* noted above (p. 170). Madoc found very little evidence of migrants on his two visits, and his party identified only three species, *Falco peregrinus*, *Eudynamis scolopacea* and *Terpsiphone paradisi*: in addition Wyatt-Smith records an unidentified rail seen in January on Pulau Labohan Bilek (Madoc, *supra*: 151).

The following table gives the specimens taken by Robinson's collectors in November, 1906, where the information is available. Where there is no precise indication of the number of specimens taken, a single plus sign (+) is given if the account shows that the bird was present in small numbers; and a double plus sign (++) if it appeared to be more plentiful. Visual records are marked as "seen". The data for these species for Pulau Jarak, the Sembilan Islands, the One Fathom Bank and Pulau Pisang are taken from the corresponding table in *Bull. Raffles Mus.*, 23, 1950, pp. 289-98.

Checklist Number and Name	Aroa Is	Jarak	Sembilan Is	One Fathom Bank	Pisang
Family ARDEIDAE					
23. <i>Nycticorax n. nycticorax</i> (Linn.)	1 imm.	...	...	...	...
24. <i>Gorsachius m. melanocephalus</i> (Raffles)	1 imm.	2 ♂, 2 ♀	1 ♂	...	...
28. <i>Dupetor f. flavicollis</i> (Latham)	1 ad., 1 imm.	1 ♂, 2 ♀	1 ♀	1 ♂, 4 ♀	+
Family ACCIPITRIDAE					
46. <i>Pernis apivorus orientalis</i> Tacz.	1 ♀ imm.	...	...	...	...
52. <i>Accipiter virgatus gularis</i> (T. & S.)	30+	3 ♂, 6 ♀	3 ♂ imm., 10 ♀ imm.	1 ♀	+
Family FALCONIDAE					
74. <i>Falco peregrinus calidus</i> Latham	2 ♂, 1 ♀	2 imm.	1 ♀	...	...
Family RALLIDAE					
100. <i>Amaurornis phaeicurus chinensis</i> (Bodd.)	1 ♂	1 ♂, 3 ♀	...	1 ♂, 1 ♀	...
Family CHARADRIIDAE					
117. <i>Numenius phaeopus variegatus</i> (Scop.)	1 ♀	...	...	...	...
128. <i>Actitis hypoleucos</i> (Linn.)	1 ♀	1 ♂	+	...	+
Family COLUMBIDAE					
168. <i>Ptilinopus jambu</i> (Gmelin)	1 ♂	...	2 ♂, 4 ♀	6 ♂, 5 ♀	+

Checklist Number and Name	Aroa Is	Jarak	Sembilan Is	One Fathom Bank	Pisang
Family CUCULIDAE					
182. <i>Clamator coromandus</i> (Linn.)	++	...	1 ad.	1 ♀	+
185. <i>Cuculus fugax nasicolor</i> (Blyth)	3 ad., 6 imm.	...	2 ♀ imm.	3 ♂, 1 ♀	...
186. <i>Cuculus m. micropterus</i> Gould	1 ad., 4 imm.	1 ♀	1 ♀	1 ♂	+
187. <i>Cuculus s. saturatus</i> Blyth	1 ♂	...	...	...	...
196. <i>Surniculus lugubris dicruroides</i> (Hodgs.)	1 ad.	1 ♂	2 ♂, 2 ♀	1 ♂, 7 ♀	+
197. <i>Eudynamis scolopacea</i> (Linn.), subsp.	++	2 ♂	5 ♂, 11 ♀	...	+
Family STRIGIDAE					
212. <i>Otus scops malayanus</i> (Hay)	?seen	1 ♂	1 ♀	1 ♀	...
219. <i>Ninox s. scutulata</i> (Raffles)	1 ♂	2 ♂, 4 ♀	...	1 ♀	...
Family CAPRIMULGIDAE					
228. <i>Caprimulgus indicus jota</i> (T. & S.)	4 ad.	1 ♀	1 ♂, 1 ♀	1 ♂	+
Family ALCEDINIDAE					
253. <i>Ceyx e. erithacus</i> (Linn.)	1 ♀	1 ♀	1 ♀	10 ♂, 2 ♀	+
258. <i>Halcyon e. coromanda</i> (Lath.)	1 ad.	6 ♂, 3 ♀	...	3 ♂, 3 ♀	+
260. <i>Halcyon pileata</i> (Bodd.)	2 ♂, 3 ♀	2 ♂	1 ♂	1 ♂	+
Family CORACIIDAE					
268. <i>Eurystomus orientalis</i> (Linn.), subsp.	7 imm.	1 ♀	3 ♂, 2 ♀	1 ♀	+
Family PITTIDAE					
328. <i>Pitta brachyura cyanoptera</i> Temm.	++	1 ♂	1 ♀	11 ♂, 10 ♀	+
330. <i>Pitta sordida cucullata</i> Hartl.	+	2 ♂, 1 ♀	1 ♀	1 ♂, 10 ♀	+
Family DICRURIDAE					
346. <i>Dicrurus a. annectans</i> (Hodgs.)	++	7 ♂, 1 ♀	...	...	+
Family TURDIDAE					
446. <i>Luscinia e. cyane</i> (Pall.)	1 ♂ imm.	3 ♂	1 ♂	6 ♀	...
458. <i>Turdus o. obscurus</i> Gmel.	++	1 ♂	6 ♂, 5 ♀	1 ♂, 1 ♀	+
Family SYLVIIDAE					
471. <i>Locustella lanceolata</i> (Temm.)	1 ♂, 2 ♀	4 ♂, 2 ♀	3 ♂	5 ♂, 9 ♀	+
Family MUSCICAPIDAE					
493. <i>Muscicapa ferruginea</i> (Hodgs.)	1 ♀	1 ♂, 1 ♀	2 ♂	2 ♂, 1 ♀	+
494. <i>Muscicapa l. latirostris</i> Raffles	1 ♂	2 ♂	...	3 ♂	...
515. <i>Terpsiphone paradisi incei</i> (Gould)	1 ♀	1 ad. ♂, 2 imm.	1 ♂	1 ♀	+

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